ARCS

Remedial Planning Activities
At Selected Uncontrolled
Hazardous Substance Disposal Sites
In The Zone of Regions VI, VII and VIII

Environmental Protection Agency

Contract No. 68-W9-0053

SITE INSPECTION PRIORITIZATION

Rico-Argentine
Rico, Colorado

Work Assignment No. 21-8JZZ

OCTOBER 11, 1994

URS
CONSULTANTS, INC.

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Harza Environmental Services, Inc.
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Western Research Institute

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CERCLIS ID #COD980952519

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SITE INSPECTION PRIORITIZATION

Rico-Argentine
Rico, Colorado

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1.0 INTRODUCTION

URS Consultants, Inc. (URS) has been tasked by the U.S. Environmental Protection Agency (EPA) under the Alternative Remedial Contracts Strategy (ARCS) Contract Number 68-W9-0053 to conduct a Site Inspection Prioritization (SIP) (Work Assignment Number 21-8JZZ) for the Rico-Argentine (R-A) site (CERCLIS ID# COD980952519) located north of Rico, Colorado, 81332. Previous work at the site includes an EPA Potential Hazardous Waste Site - Site Inspection Report (Form 2070-13) compiled by State of Colorado, Department of Health (CDH) personnel in June 1984 and a second Form 2070-13 completed by an EPA contractor, Ecology and Environment (E&E), in November 1984. An EPA surface water and sediment sampling effort was conducted by E&E on November 14, 1984 and an Analytical Results Report (ARR) was delivered to the EPA on July 29, 1985. The U.S. Department of the Interior, Bureau of Reclamation (BOR) has conducted surface water and sediment sampling on Silver Creek and the Dolores River several times a year from 1989 through 1993 (Ecology and Environment (E&E) 1985; U.S. Environmental Protection Agency (EPA) 1984a; EPA 1984b; U.S. Department of the Interior, Bureau of Reclamation (BOR) 1994). This SIP was assigned to a URS investigator on April 11, 1994.

2.0 OBJECTIVES

The purpose of this SIP is to review existing data for the A-R site and identify whether data gaps exist with respect to the revised Hazard Ranking System (HRS) at the R-A site, and to provide sufficient documentation for the EPA to determine the human health and environmental impacts posed by the R-A site, thus determining the appropriate future course of action.

The specific objectives of this SIP are to:

- Summarize the previous work at the R-A site;
- Identify, quantify (if possible) and characterize source areas attributable to this site;
- Identify waste availability to each migration pathway;
- Identify whether there is a potential for, or actual impact on, receptor targets; and
- Identify relevant data gaps for each migration pathway.

3.0 BACKGROUND

3.1 SITE LOCATION

The R-A site encompasses approximately 75 acres of settling ponds near the east end of Dolores County in the Rico Mountains in the southwestern corner of Colorado (Figure 1). A total of approximately 2,500 acres of mining operations have been consolidated under one ownership (EPA 1984b). The Rico Mountains are a subsidiary group of peaks on the southwest fringe of the San Juan Mountains (U.S. Geological Survey (USGS) 1974). The legal description for the R-A site is the southeast quarter of Section 25, Township 40 N, Range 11 W. The approximate site coordinates are 37° 42′ 05″ North latitude and 108° 01′ 39″ West longitude. The site can be reached by proceeding south from Telluride, Colorado on State Highway 145 over Lizard Head Pass to Rico or by proceeding north from Cortez on State Highway 145.

3.2 SITE DESCRIPTION

Site description information included here is taken primarily from EPA; CDH; and State of Colorado, Division of Mines (DOM) file documents. The R-A site is an inactive mining operation located in portions of two drainages, Silver Creek and the Dolores River, above the town of Rico. Silver Creek and the Dolores River have their confluence within the town of Rico (Figures 1 and 2). The underground mine workings are interconnected and the drainage water from the mines is sent to the St. Louis Tunnel Adit where it is discharged into a slaked lime water treatment plant and then a series of 18 settling ponds before discharging into the Dolores River. The R-A complex has had a National Pollutant Elimination Discharge System (NPDES) permit (#CO-0029793) for this discharge system since 1976 but has been frequently in violation of permit standards (U.S. Environmental Protection Agency, Water Management Division (WMD) 1994). The discharge has also been regulated under the Colorado Pollutant Discharge Elimination System (CPDES). The discharge averages approximately 1.1 to 1.5 million gallons per day (MGD) (WMD 1994). The St. Louis Tunnel Adit is approximately three-quarters of a mile to the north of Rico (USGS 1960). Near the St. Louis Tunnel Adit on the Dolores River are also a large, inactive sulfuric acid plant and two cyanide heap

leach basins. Approximately one mile northeast up Silver Creek are located another series of tailings piles and settling ponds, the Blaine Tunnel and the Rico-Argentine Mill (Figure 2). The entire Rico area has been heavily mined in the past. The R-A region is primarily Bureau of Land Management (BLM) property located within the San Juan National Forest with surrounding peaks up to 14,000 feet above mean sea level (msl) and summits in the Rico Mountains over 12,000 feet above msl. The town of Rico and the Dolores River settling ponds are at 8,800 feet above msl and the Silver Creek operations at 9,200 feet above msl (USGS 1960).

3.3 SITE HISTORY AND PREVIOUS WORK

The early history of the Rico mining district began with prospecting attempts in 1861. Eight years later, several claims were staked at the confluence of the Dolores River and Silver Creek and the area became known as the Pioneer District. Over the next ten years, several additional claims were staked but mining was intermittent. In 1879, rich oxidized silver ore was discovered on Nigger Baby Hill and a mining settlement established. A few small smelters were built but operations were short-lived. Silver production rose to a temporary peak in 1883 and then fell off over the next three years. In 1887, a prospect shaft on Newman Hill struck the edge of the richest ore body (a blanket-type) ever found in the area and development accelerated. By 1890, the Rio Grande Southern Railroad Company completed a narrow-gauge line into the camp and the all-time peak of silver production was reached in 1893 (USGS 1905; USGS 1974).

By 1895, exploration and production activity showed signs of abating, partly due to the silver panic of 1893 and partially due to exhaustion of the major ore bodies. In 1902, all of the important mines in the district were consolidated under the United Rico Mines Company which began production of base-metal ores. By 1905, the combined values of lead and zinc production exceeded that of silver. Activity in the Pioneer District waxed and waned with the economics of mining during the next several years with World War I temporarily stimulating production followed by a low ebb in 1921 (USGS 1905; USGS 1974). The Rico Argentine Mining Company (RAMC) was started in 1915 with capital from Utah and quickly became a major producer in the district (State of Colorado, Division of Natural resources, Bureau of Mines (BOM) 1915).

Advances in the metallurgical industry, particularly in flotation processes, made Rico's complex sulfide ores more attractive in the mid-1920s. Ores were shipped to custom flotation mills in Salt Lake City until 1926 at which time a 250-ton custom mill was built at Rico by the International Smelting Company, a subsidiary of Anaconda Mining Company. The RAMC, working the south side of Silver Creek, was one of the major producers during this period. Base-metal peak production occurred in 1927, by 1928 the custom mill in Rico had shut down, in 1929 the Depression drove down the economy and by 1932 production had ceased (USGS 1974).

Mining resumed in 1934 and activities fluctuated until 1939 when RAMC finished a 135-ton flotation mill and started steady production (BOM 1939a; BOM 1939b). The RAMC obtained control of most of the mining properties in the district during this time (BOM 1942a; USGS 1974). By 1940, the mill capacity was up to 150 tons (BOM 1940; USGS 1974). In the early 1940s, RAMC began selling pyrite ore to vanadium producers in Utah (BOM 1942b; BOM 1943). The narrow-gauge railroad line was abandoned in 1951 for economic reasons. By 1955, the long crosscut from the Argentine shaft on Silver Creek to the St. Louis tunnel on the Dolores River was finished, lowering the water level in the Silver Creek workings by 450 feet. Also in 1955, RAMC completed and put in operation a plant for the production of sulfuric acid from pyrite near the St. Louis Adit. Nine years later, the plant was put on standby basis due to a cutback in the uranium program in which the sulfuric acid was used (USGS 1974).

On May 26, 1971, all RAMC mining operations ceased, equipment below the "500 level" was removed and the lower levels allowed to flood and drain through the St. Louis Tunnel (BOM 1971). In 1973, RAMC sampled the old mine dumps and began work on a 300 foot by 500 foot leaching pad next to the old sulfuric acid plant. A Hypalon liner was installed in this leach pad. A precipitation and recovery process using three pounds of cyanide per ton of water was begun on a pile containing approximately 100,000 tons of raw ore. Early in the start-up, an overflow of the leaching liquor occurred with an unknown amount released to the Dolores River (BOM 1974). In 1974, approximately $1,200,000 of production, including gold and silver, was obtained (State of Colorado, Division of Mines (DOM) 1975a). In 1975, an additional leach pad containing 55,000 tons of raw ore was constructed in a settling pond originally used by

the acid plant. A Hypalon liner was placed in this pad and a 3% to 4% cyanide solution used with added lime (DOM 1975b).

The Anaconda Copper Company (ACC) acquired the Rico Argentine Mine property from RAMC in 1980. ACC began a surface drilling program for exploration, mostly of molybdenum (Anaconda Minerals Company (AMC) 1994; DOM 1980; DOM 1981). ACC continued with both surface and underground exploratory drilling over the next several years (AMC 1994; DOM 1982; DOM 1983). ACC also built a water treatment plant at the St. Louis Tunnel discharge and carried out several other environmental efforts such as pond stabilization, adit plugging, and capping of wells (AMC 1994; WMD 1994).

In 1984, an EPA Potential Hazardous Waste Site - Site Inspection Report (Form 2070-13) was completed after a site visit by two CDH geologists. Minimal information is contained in the report although it did discuss a NPDES permit issued to RAMC in 1976 with a compliance schedule (EPA 1984a). This permit has been renewed several times and currently is in effect through September 30, 1995 (WMD 1994). The report also stated that the CDH Water Quality Control Division (WQCD) issued a Notice of Violation (NOV) and a Cease and Desist Order (CDO) in 1980 because of RAMC problems in meeting compliance limitations (EPA 1984a). The NOV and CDO were amended on December 17, 1981, and specified exceedances of zinc and copper standards. This led to the development of a water treatment system using slaked lime at the St. Louis Tunnel Adit (WMD 1994). In October 1984, E&E's Field Investigation Team (FIT) conducted a site visit which confirmed that ACC had started water treatment operations using slaked lime at the St. Louis Adit. E&E personnel also found two piezometer wells, between the Silver Creek tailings ponds and Silver Creek, apparently installed in 1981 by Dames and Moore as part of a geotechnical study on the stability and potential expansion of the ponds (E&E 1984a). A sampling plan was issued on October 18, 1984 (E&E 1984b). Field sampling was conducted on November 14, 1984 and involved the collection of nine surface water samples and eight sediment samples. No source or target samples were collected during the sampling effort. Field personnel noted that leachate appeared to be migrating from the settling ponds above Silver Creek to Silver Creek. They also noted that both surface water bodies contained iron-stained cobbles (E&E 1984b; E&E 1984c; EPA 1984b). An ARR

was issued by E&E in 1985. The ARR concluded that the surface water samples contained elevated manganese concentrations and that the sediment samples contained arsenic, cadmium, copper, iron, lead, manganese and zinc at much higher concentrations than upgradient samples (E&E 1985). A NOV was issued by CDH to ACC for cadmium permit standard violations in November and December 1984 (WMD 1994).

In 1988, ACC sold their holdings in the Pioneer District, approximately 2,500 acres, to the Rico Development Corporation (RDC), a division of Crystal River Exploration and Production Company (AMC 1994; CDH 1988; EPA 1984b; WMD 1994). Fish tissue samples collected from September 1989 through March 1991, at reservoirs approximately 40 miles downstream from the R-A site, were found to contain high levels of mercury (E&E 1991a; E&E 1991b). The U.S. Department of the Interior, Bureau of Reclamation (BOR) began surface water and sediment sampling in 1989 along the upstream reaches of the Dolores River and its tributaries to determine potential sources of the mercury. This sampling has continued periodically every year through 1993. The sediment data show Silver Creek to be the major source of heavy metals, including mercury, in the upper Dolores River basin. The April 1992 water samples indicate that, in addition to Silver Creek, there are numerous sources of mercury in the upper Dolores River basin and many of them are located well downstream from Silver Creek. The study also shows metal loading from various mine drainages which contribute to contamination of the Dolores River (BOR 1994).

Since RDC obtained the property from ACC, violations of the discharge permit have continued. Another NOV and CDO were issued in 1990 for violations of lead and silver standards. Unpermitted discharge from the Blaine Tunnel on Silver Creek also was reported in 1990 which resulted in construction of a concrete dam by RDC to plug the Blaine Tunnel (WMD 1994). The St. Louis Tunnel discharge has also repeatedly failed the Whole Effluent Toxicity (WET) testing required by the NPDES permit. An additional NOV was filed in 1993 for silver violations and a notation made about wastewater flowing into the cyanide basins in which the old Hypalon liners are visibly weathered and torn. In 1994, the permit violations have included silver, lead and zinc (WMD 1994; WQCC 1993).

In April 1994, the property was sold to Azure, Inc., a development company from Phoenix, Arizona, who is looking into real estate development possibilities. Azure, Inc. has retained Walsh and Associates as a consultant (Theile 1994).

It has been reported that a large amount of tailings has been moved from tailings piles to the town of Rico for use as gravel road cover. The amount of tailings moved and the years this operation has been used are both unknown at this point (EPA 1994).

3.4 SITE GEOLOGY

Detailed information about the geology of the R-A site area can be found in "Geology of the Rico Mountains, Colorado" by Whitman Cross and Arthur Coe Spencer (USGS 1900); "Geologic Atlas of the United States, Rico Folio" by Whitman Cross and F. L. Ransome (USGS 1905) and "Geology and Ore Deposits of the Rico District, Colorado" by Edwin T. McKnight (USGS 1974).

The geology of the Rico Mountains is extremely complex with the dominant structure of the district a faulted dome centered near a monzonite stock. A central faulted horst block of Precambrian rock has been uplifted about 6,000 feet. The lower slopes of the Rico district are generally covered by debris from the hillsides from wash, talus and landslide processes (State of Colorado, Geological Survey (CGS) 1975; USGS 1900; USGS 1905; USGS 1974).

Bedrock in the district ranges from Precambrian to Permian. Precambrian rocks include older greenstone and metadiorite and later Uncompaghre Quartzite which is at least 1,000 feet thick. Overlying the Precambrian is Devonian age Ouray Limestone succeeded by Mississippian Leadville Limestone with a combined thickness of approximately 169 feet. Both formations have been metamorphosed by the monzonite intrusive body. Approximately 2,800 feet of Hermosa Formation (Middle Pennsylvanian age) is the next youngest strata. The Hermosa Formation is of great economic interest because most of the ore deposits of the district occur in it, particularly in its limestone beds. The Hermosa is overlain by the Rico Formation (300 feet thick) of Middle and Late Pennsylvanian age. The highest formation exposed in the district is the Cutler

Formation of Early Permian age with at least 2,800 feet of strata remaining (USGS 1900; USGS 1905; USGS 1974).

At the end of the Mesozoic Era, the sedimentary sequence was intruded by sills and dikes of hornblende porphyry. At a later stage, the sequence was intruded by a less silicic stock of monzonite. Channelized metamorphism may extend up to 1.7 miles from the stock (USGS 1974).

The ore deposits of the district consist of (USGS 1905; USGS 1974):

- Massive sulfide replacement deposits in the limestones of the Hermosa Formation;
- Contact metamorphic deposits of sulfides and iron oxides in limestones of Ouray, Leadville and Hermosa Formations;
- Veins on fractures and small faults in Hermosa sandstones and arkoses; and
- Replacement deposits in residual debris in lower the Hermosa Formation (the rich blanket deposits).

3.5 SITE HYDROGEOLOGY

No hydrogeologic studies of this area were located during this investigation; thus, the following discussion is based on assumptions from available geologic studies. The principal aquifer in the R-A site area is the shallow alluvial aquifer.

As stated in Section 3.4, Site Geology, the valley sides and bottom are thickly covered by detritus from weathering and erosion. This material forms a shallow unconfined aquifer through which the streams and rivers of the region flow. Hydraulic conductivity is assumed to be fairly high (10^{-2} centimeters per second (cm/s)) (Office of the Federal Register 1990). The direction of shallow groundwater flow is estimated to be south along the Dolores River and southwest along Silver Creek (EPA 1994b). Some

local areas, such as near tailings piles, may seal themselves through the sifting of fine-grained material (BOR 1994). The shallow aquifer is heavily mineralized in most cases. The State of Colorado, Division of Highways, drilled a well on the south end of the town of Rico for water supply for a maintenance shop but had to abandon it after a couple of years due to heavy mineralization in the pipes (State of Colorado, Department of Transportation (CDOT) 1994; State of Colorado, Office of the State Engineer (CSE) 1994).

Deeper bedrock aquifers exist in the various limestone strata in the older formations and in the fractures in the formations. Several of the old exploratory drill holes on the Dolores River portion of the site, flowed water and had to be capped (AMC 1988; AMC 1994). Groundwater reaches the surface in the form of several seeps and springs found in the area and a number of these appear to be geothermal in nature. One drill hole is used by locals to supply hot water to a pool the locals use to soak in (Jahnke 1994). Many of the springs contain carbonic acid gas and sulphureted hydrogen (USGS 1905), some springs are calcareous due to the high carbonate of lime contained by many of the geologic formations and several springs are iron-bearing and have left local deposits of iron oxide (USGS 1900). In the vicinity of the R-A couple, deep groundwater has been allowed to flood the abandoned workings and is discharged through the St. Louis Tunnel Adit to a small treatment system (EPA 1984b; WMD 1994).

3.6 SITE HYDROLOGY

The Dolores River and its Silver Creek tributary are the major surface water bodies in the R-A site area. The Dolores River flows to the south past the St. Louis Tunnel Adit, the old sulfuric acid plant, the cyanide heap leach basins, and numerous tailings piles and settling ponds (USGS 1960). Silver Creek flows to the southwest and is the source of the town of Rico's drinking water. Below the drinking water diversion, Silver Creek flows past several mine workings including the Blaine Tunnel and the Rico-Argentine Mill and settling ponds. Silver Creek flows through the town of Rico before joining the Dolores River on the western edge of Rico. The only flow rate data is from a gage on the Dolores River at a point four miles below Rico. At this station the 41-year annual mean flow rate is 136 cubic feet per second (cfs) and the upstream drainage basin

encompasses 105 square miles (mi^2) (USGS 1993). The Dolores River is not used as a source of municipal drinking water; however, there are twelve listed diversions within fifteen downstream miles of the R-A site. The St. Louis Tunnel is the only diversion with domestic use listed, as well as industrial and stockwatering; however, it is doubtful that any domestic use actually occurs from this water source. The other surface water diversions are used for irrigation, stockwatering, industrial, recreation, fire and other purposes (CSE 1994).

3.7 SITE METEOROLOGY

The R-A site is located in a semiarid climate zone. The mean annual precipitation, as totaled from the University of Delaware (UD) database, is 12.8 inches. The net annual precipitation as calculated from precipitation and evapotranspiration data obtained from the UD is 4.1 inches (University of Delaware (UD) 1986). The 2-year, 24-hour rainfall event for the site is approximately 1.5 inches (Dunne and Leopold 1978).

4.0 PRELIMINARY PATHWAY ANALYSIS

This following analysis will consider potential site impacts on the air pathway, groundwater pathway, surface water pathway, and soil exposure pathway utilizing HRS guidelines (Office of the Federal Register 1990).

4.1 SITE SOURCE QUANTITY AND CHARACTERISTICS

Source areas at the R-A site include the estimated 75 acres of tailings piles and settling ponds along both the Dolores River and Silver Creek and an unknown amount of tailings moved into the town of Rico as street cover. This material has been removed from mining operations near Rico and has reportedly caused dying yards in Rico (EPA 1984b; EPA 1993). The St. Louis Tunnel discharge of 1.1 to 1.5 MGD is also considered a R-A source (WMD 1994).

The source areas are estimated to contain 400,000 tons of material at the R-A site (EPA 1984b). A number of sampling efforts have been conducted at the site. These include

an ACC contractor from 1980 through 1983, EPA-sponsored sampling in 1984 and BOR sampling from 1989 through 1993. These sampling efforts focused on surface water and sediment analyses (EPA 1984b; E&E 1985; BOR 1994). No characterization of the tailings piles, tailings ponds or settling ponds has been located in the file search; however, review of geologic studies, mining texts and personal conversations with employees of the old mining companies, leads to an assumption that cyanide and the heavy metals typically associated with sulfide ores would be the contaminants of concern in the source areas. No mention of the use or storage of any other hazardous wastes was found in the files.

From reports in EPA, CDH and BOR files, it is assumed that all tailings piles, tailings ponds and settling ponds were constructed with native material without liners or run-on/runoff controls. The two cyanide heap leach pads that were built did incorporate Hypalon liners and overflow berms but these have not been maintained to the present time (BOM 1974; DOM 1975b, WMD 1994).

4.1.1 Source Area Data Gaps

No source characterization sampling has been conducted at the R-A site.

4.2 AIR PATHWAY

No ambient air monitoring has been performed at the R-A site. The air pathway was evaluated on the potential to release.

4.2.1 Target Populations

Approximately 92 people live in the town of Rico and 123 residents are listed in the U.S. Census Bureau's Rico division which is within the four-mile target distance limit (U.S. Department of Commerce (USDOC), Bureau of the Census 1990). The Rico area is experiencing recent population growth due to growth and overcrowding in Telluride. Due to the tailings that have been moved into Rico, it is assumed that all 92 residents of Rico live on a source area. From U.S.

Geological Survey topographic maps, the portion of Rico that appears to still have houses covers approximately two square miles equal to 1,280 acres (USGS 1960). It has been reported that ACC owned 2,500 acres in the Rico area; from this it is assumed that all 123 residents of the Rico division live on a source area.

The federally listed threatened and endangered Bald eagle (*Haliaeetus leucocephalus*) (threatened), Peregrine falcon (*Falco peregrinus*), Mexican spotted owl (*Strix occidentalis lucida*) (threatened), Southwestern Willow Flycatcher (*Empidonox trailli extimus*) (proposed endangered), and Black-footed Ferret (*Mustela Nigripes*) (endangered) potentially inhabit the area (U.S. Department of the Interior, Fish and Wildlife Service (FWS) 1994). Federal candidate (Category 2) species North American wolverine (*Gulo gulo luscus*), Northern goshawk (*Accipiter gentilis*), Black Tern (*Chlidonias niger*), Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), Round tail chub (*Gila robusta*), and Flannelmouth sucker (*Catostomus latipinnis*) may also inhabit the Rico area (FWS 1994).

No National Wetland Inventory maps have yet been prepared for this area (Earth Science Information Center (ESIC) 1994). The EPA's 1984 sampling effort did not identify wetlands or critical habitat within one mile of the site (EPA 1984b); however, it is reasonable to assume that forested and emergent wetland vegetation exists within the specified four-mile target distance limit. A significant community of montane riparian forest (*Populous augustifolia-Picea pungens/Alnus incana*) can be found on the east bank of the Dolores River within four miles of the site. This natural community is ranked rare to uncommon both globally and in Colorado (Colorado Natural Heritage Program (CNHP) 1994).

4.2.2 Air Pathway Specific Data Gaps

After performing an analysis of all potential sources on site, URS was not able to identify additional areas where data acquisition is required.

4.3 GROUNDWATER PATHWAY

The groundwater pathway was evaluated on the potential to release. No groundwater monitoring data is available. The CPDES permit monitoring does show a release of silver, lead and zinc from groundwater drainage discharging from the St. Louis Tunnel (WMD 1994).

4.3.1 Target Populations

The population potentially impacted by groundwater contamination consists of the users of three wells listed as household use by the Colorado State Engineer (CSE 1994). Two of these wells are located approximately one-half mile upgradient of the St. Louis Tunnel Adit and it's associated sources on the Dolores River. According to the owner of one of these wells, no water quality problems have been encountered since drilling the well for a drinking water source in 1990 (Jahnke 1990). The state engineer lists the well depth as 160 feet; however, the owner was unsure what depth the screened interval was placed (CSE 1994; Jahnke 1994). The third domestic well is at the south end of the town of Rico, approximately one and one-half miles downgradient of the source areas and below the confluence of Silver Creek and the Dolores River (CSE 1994; USGS 1960). Approximately six people use these wells, possibly for drinking water (Jahnke 1994; USDOC 1990).

4.3.2 Wellhead Protection Area

The R-A site does not lie within a state or federally designated wellhead protection area (State of Colorado, Department of Health, Water Quality Control Division (WQCD) 1994).

4.3.2.1 Resource Use

Groundwater within the specified four-mile target distance limit is limited to the three household wells discussed in Section 4.3.1 and one

industrial use well owned by the Rico Development Corporation (CSE 1994).

4.3.3 Groundwater Pathway Specific Data Gaps

After performing an analysis of all potential site-related sources and associated receptor targets, URS has been able to identify the following area where additional data acquisition is required:

- Water quality analyses of the three domestic wells, particularly the single downgradient well.

4.4 SURFACE WATER PATHWAY

The surface water pathway was evaluated on observed release. Section 3.3, "Site History and Preview Work," describes a number of investigations and sampling efforts in the Rico area. EPA consultants observed leachate from settling ponds on Silver Creek entering the surface water, and iron-stained cobbles in both Silver Creek and the Dolores River. The same consultant sampled surface water and sediments and detected elevated manganese in the surface water and elevated arsenic, cadmium, copper, iron, lead, manganese and zinc in the sediments. Sampling by the BOR determined that Silver Creek is the major source of mercury and other heavy metals in the upper Dolores River basin. In addition, there have been numerous and continuing permit violations for the R-A settling pond discharge point to the Dolores River. These violations have been of cadmium, lead, silver and zinc. Observations have been made of wastewater flowing into cyanide basins with potentially leaking liners (WQCD 1993).

4.4.1 Drinking Water Threat

The drinking water threat is used to evaluate the threat associated with the actual or potential release of hazardous substances from a site to drinking water resources. There are no municipal drinking water diversions within fifteen downstream miles from the R-A site on the State Engineer's Water Rights

Report. There are twelve total diversions on the Dolores River, one of which includes domestic use in its multiple use codes. This water right is listed as the St. Louis Tunnel and includes industrial and stockwatering as its other uses (CSE 1994).

The town of Rico obtains its drinking water from a diversion on Silver Creek above the potential impacts from R-A mining operations (Figure 2). The water is treated through infiltration galleries and chlorinated (E&E 1984c).

4.4.2 Human Food Chain Threat

The human food chain threat is used to evaluate the threat associated with the actual or potential release of hazardous substances to surface water containing human food chain organisms. ACC contractors found decreased aquatic life in the Dolores River in the 1980s, but did not attribute it to the site (EPA 1984b). A number of federally listed threatened and endangered fish may utilize the surface water habitat as discussed in the next section under Environmental Threat.

The State of Colorado, Division of Wildlife (CDOW) conducted fish studies on two 500 foot reaches of the Dolores River near Spruce Creek, one and one-half miles below Rico, in 1982 and found three rainbow trout between ten and twelve inches in length and one small brown trout. The CDOW performed habitat improvement in the form of instream boulders and check dams which led to increased populations of brown trout between five and six inches in length in 1983. By 1984, CDOW fish sampling showed greatly increased populations of ten to twelve inch brown trout and slightly increased populations of rainbow and brook trout (State of Colorado, Division of Wildlife (CDOW) 1994a). Local bait and tackle shops confirmed the presence of harvestable game fish in the upper reaches of the Dolores River (Duranglers 1994). The Dolores River above Rico experiences heavy fishing pressure and CDOW stocks fish in the river through the town of Rico. The upper head-waters of the Dolores River support a viable native cutthroat trout fishery. Silver Creek has little aquatic life because

of the heavily mineralized water below the mines; however, CDOW has stocked native cutthroat trout approximately two miles above Rico in Silver Creek and they are doing relatively well (CDOW 1994b).

4.4.3 Environmental Threat

The environmental threat is used to evaluate the threat associated with the actual or potential release of hazardous substances from a site to sensitive environments specified by state and federal statutes. While no National Wetland Inventory maps are available for the upper Dolores River area, it may be assumed that a limited amount of emergent vegetation exists within the specified fifteen-mile downstream target distance limit. The 1984 EPA sampling effort did not identify wetlands or critical habitats within one mile of the site (EPA 1984b). A significant montane riparian forest can be found on the east bank of the Dolores River within four downstream miles of the site area (refer to Section 4.2.1 for more discussion). Another montane riparian forest community (*Populous augustifolia/Cornus sericea*) occurs along the Dolores River approximately fifteen miles downstream from the R-A site. This natural community is ranked very rare globally and in Colorado (CNHP 1994).

Federally listed threatened and endangered aquatic species that potentially use the Dolores River include the Colorado squawfish (*Ptychocheilus*), the Humpback chub (*Gila cypha*), the Bonytail chub (*Gila elegans*) and the Razorback sucker (*Xyrauchen texanus*). Federal candidate species include the Flannelmouth sucker (*Catostomus latipinnis*), the Roundtail chub (*Gila robusta*) and the Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) (FWS 1994a; FWS 1994b).

4.4.4 Surface Water Pathway Specific Data Gaps

After performing an analysis of all potential site-related sources and associated receptor targets, URS identified the following data gap with regard to the surface water pathway:

- Determination of whether proximal impacted wetlands are present on the Dolores River.

4.5 SOIL EXPOSURE PATHWAY

The soil exposure pathway was evaluated based on the containment of on-site sources and the presence of observed contamination to both on- and off-site soils. No soil sampling has been conducted at the R-A site.

4.5.1 Target Populations

4.5.1.1 Resident Populations

There are no known residents living on the R-A site or within 200 feet of source areas at the R-A site (USGS 1960). The site is inactive; therefore, no workers are on-site.

A resident population may exist. RBS

4.5.1.2 Nearby Populations

Based on census data for the town of Rico, the Rico division and Dolores County, approximately 123 people reside on, or live within 200 feet of, contaminated soil areas (USDOC 1990; USGS 1960). There are no restrictions to access of source materials on the site. Access roads lead to mine adits, mills, tailings and ponds with no gates or fencing (EPA 1984b). Most of the mining properties in the R-A region were originally patented and are now on private property with approximately 2,500 acres combined under one ownership. The R-A area is situated within the San Juan National Forest with small public land parcels mixed within the private mining properties. The area receives high recreational use.

4.5.1.3 Terrestrial Sensitive Environments

The endangered Black-footed ferret and Bald eagle may utilize the R-A area. The proposed endangered Southwestern willow flycatcher and threatened Mexican spotted owl also may be found in the Rico area (FWS 1994a; FWS 1994b). The federal candidate species North American wolverine, Black Tern and Northern goshawk may utilize the site area as habitat (FWS 1994a; FWS 1994b). Several montane riparian sensitive communities are also found in the area (CNHP 1994).

4.5.2 Soil Exposure Pathway Specific Data Gaps

After evaluating all potential site sources and associated nearby population targets, URS has identified the following data gaps with regard to the soil exposure pathway:

- No residential soil sampling has been conducted at the R-A site.

5.0 SUMMARY

The R-A site is an inactive mining area which began operations over 100 years ago as a silver producer. In later periods of operation, base-metal production from sulfide ores and sulfuric acid from pyrite ores were the major goals of the mining operations. The site exists in three areas: The Rico-Argentine Mill, mines and associated tailings piles and ponds on Silver Creek; a sulfuric acid plant, cyanide heap leach pads and settling ponds on the Dolores River; and tailings that have been moved into Rico for road cover. Cyanide heap leaching has been used in two lined ponds with at least one minor release of leachate. All mine water drainage has been routed through underground workings to discharge from the St. Louis Tunnel Adit on the Dolores River. The discharge is treated with slaked lime and is under a Colorado Pollutant Discharge Elimination System permit with input from the EPA's NPDES division. The permit limits have been continuously violated with at least two Notice of Violation and Cease and Desist Orders issued by CDH.

Approximately 123 people reside in the Rico area. Most of these residents are probably located on contaminated soils or within 200 feet of contaminated soils. There are no restrictions to access to the site. Approximately six residents potentially use groundwater as a drinking water source. Several federally listed threatened and endangered species potentially use the area or exist within the specified target distance limits. Fish are taken from the Dolores River within the fifteen-mile downstream target distance limit, but the quantity of fish taken from the river is unknown.

During this evaluation, URS was able to identify the following significant data gaps which exist for the R-A site:

- Source characterization has not been conducted;
- Location and sampling of proximal wetlands along the Dolores River (surface water pathway);
- Residential soil sampling has not been conducted at the R-A site; and
- Confirmation of the presence of threatened and endangered species.

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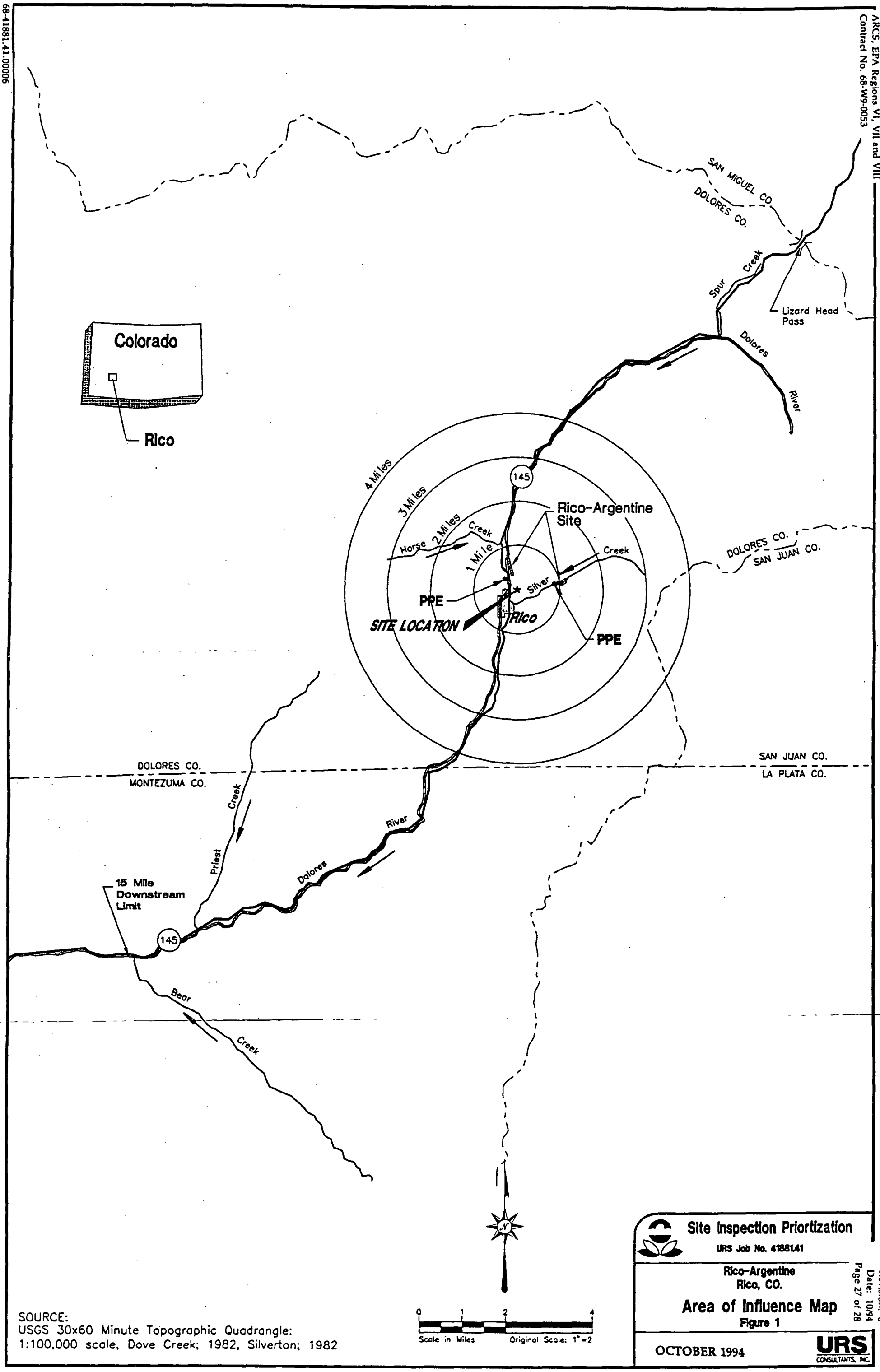

SOURCE:
USGS 30x60 Minute Topographic Quadrangle:
1:100,000 scale, Dove Creek; 1982, Silverton; 1982

Site Inspection Priortization

URS Job No. 4188141

Rico-Argentine
Rico, CO.

Area of Influence Map
Figure 1

OCTOBER 1994

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Rico-Argentine/SIP
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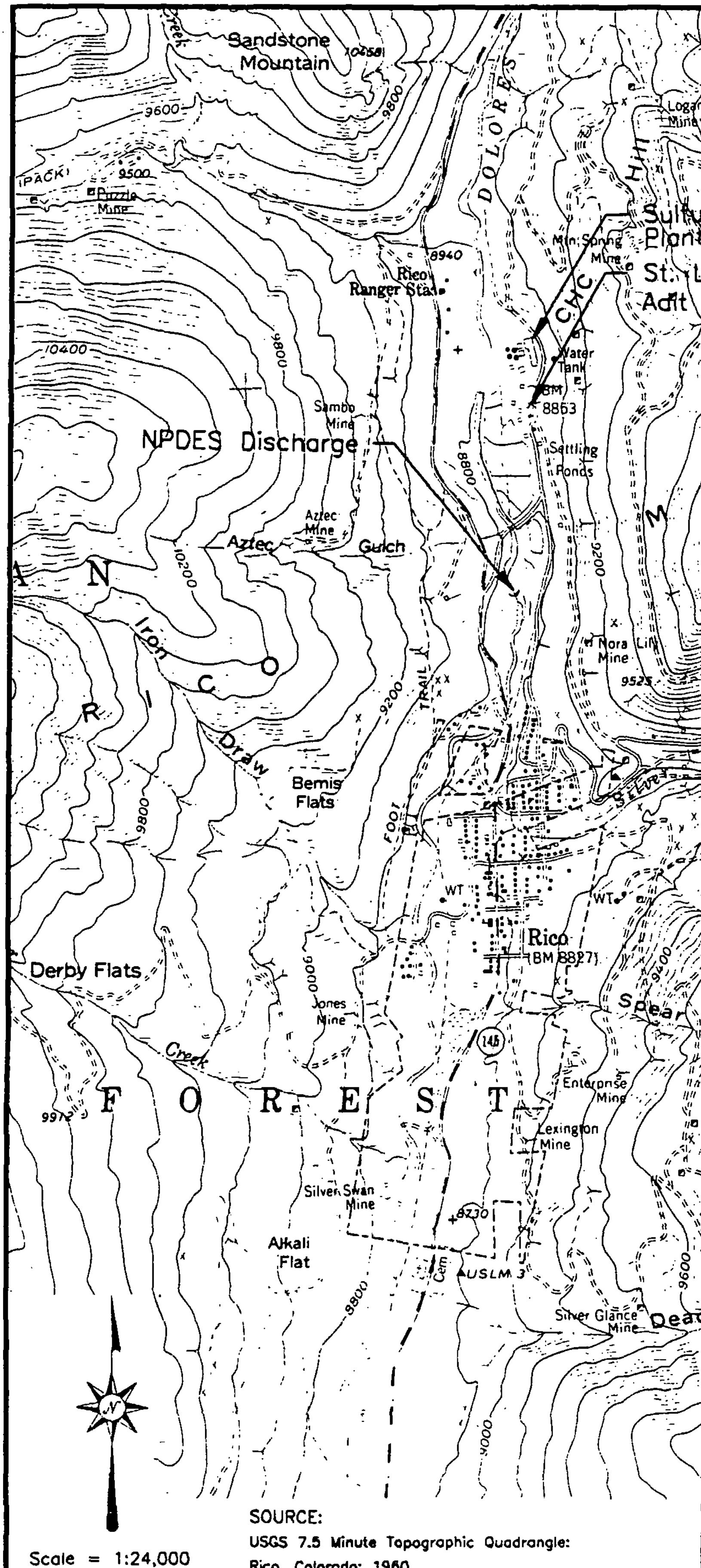

Site Inspection Prioritization

URS Job No. 4188141

Rico-Argentine
Rico, CO.

Site Map
Figure 2

OCTOBER 1994

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APPENDIX A
EPA PA Worksheet

PA WORKSHEET

Site Name Rico-Argentine City, State Rico, Colorado

CERCLIS ID # COD980952519

Reported by Michael V. Carr Date October 11, 1994

HIGHLIGHTS:

A) IS THERE QUALITATIVE OR QUANTITATIVE EVIDENCE OF A RELEASE TO AIR, SURFACE WATER, GROUNDWATER, OR SURFACE SOIL? DESCRIBE BRIEFLY.
More detail in items GW-1 (for groundwater pathway), SW-5 (for surface water pathway), A-1 (for air pathway), and SE-1 (for soil exposure pathway).

Yes, to surface water. Surface water samples collected for NPDES monitoring repeatedly detect violations of permit standards for several metals. Surface water and sediment samples collected from 1989 through 1993 by the Bureau of Reclamation show metals loading to the drainages.

B) IS THERE EVIDENCE OF AN IMPACTED TARGET POPULATION? DESCRIBE.

Pathway	Target	None/ Target Size	Brief Description	More Discussion In
Groundwater	Public drinking Water supply	None	Three wells within a four-mile radius are listed as household use. No impacts noticed by users.	Section 4.3, 5.0
	Domestic drinking Water supply	*ND (6)		
Surface Water	Drinking water	123	The upper Dolores River and upper Silver Creek are viable fisheries. CDOW improved aquatic habitat in the Dolores River below Rico in 1982 which has increased trout populations to harvestable sizes. There have been several NPDES violations on Dolores River.	Section 4.4, 5.0
	Fishery	*ND		
	Sens. env.	*ND		
Soil Exposure	People within 200'	123	Federal candidate species and state species of concern potentially exist in site area as well as several threatened and endangered species.	Section 4.5, 5.0
	Terrestrial sens. env.	*ND		
Air	Population	123	No air monitoring has been conducted.	Section 4.2

*ND - Not Determined

SITE INFORMATION

G-1. Directions to the site (from nearest easily recognized point).

From Telluride, Colorado, proceed south on State Highway 145, over Lizard Head Pass, approximately 30 miles.

G-2. Are there other potential sources in the neighborhood to be aware of as the site is evaluated? eg. Is the site in an industrial area, near a railroad, along a highway? Are sources with similar contaminants to this site in the vicinity?

Yes. Site area is heavily mined, site sources are major sources in the area; however, there are several other historical mining sites in the area, unrelated to R-A, which may affect the environment. One example is the Mountain Springs/Spill Mine upstream near the headwaters of Silver Creek which is reported to have a low pH.

Source of information: CDH Files; EPA Files; EPA 1993; USGS 1900; USGS 1905; USGS 1974

Background/Operating History

G-3. Describe the operating history of the site:

Early mining began in 1861. Silver production peaked in the 1890s and base-metal ore production peaked in 1927. A sulfuric acid production plant operated from 1955 through 1964. All mining operations ceased in 1971. Cyanide heap leaching occurred from 1973 through the late 1970s. Anaconda Minerals Company owned the property from 1980 to 1988 and explored for molybdenum. Rico Development Corporation owned the property from 1988 to April 1994 when they sold their interests to Azure, Inc., from Phoenix, Arizona. A NPDES permit was obtained in 1976. Frequent violations of the permit have occurred. BOR sampling shows loading of heavy metals to the adjoining surface water drainages.

Source of information: AMC 1994; BOM 1915; BOM 1939a; BOM 1939b; BOM 1940; BOM 1942b; BOM 1943; BOM 1949a; BOM 1974; CDH 1988; DOM 1975a; DOM 1975b; DOM 1980; DOM 1981; DOM 1982; DOM 1983; E&E 1984a; E&E 1984b; E&E 1985; E&E 1991a; E&E 1991b.

G-4. Describe site and nature of operations (property size, manufacturing, waste disposal, storage etc.):

See #G-3. Approximate site acreage is 2,500 acres. Mills, tailings piles and settling ponds near the surface water bodies cover approximately 75 acres. Many other tailings piles are located in the site area. Some tailings have been moved into the town of Rico as gravel road cover with a reported effect of dying yards. The town of Rico covers approximately 1,280 acres. Tailings piles, tailings ponds and settling ponds typical of hardrock mining comprise the source areas.

Source of information: EPA 1984a; EPA 1984b; EPA 1993; USGS 1905; USGS 1974; EMD 1994.

G-5. Describe any emergency or remedial actions that have occurred at the site:

None. Anaconda did some environmental work (plugged adits, maintained settling ponds, built water treatment plant) while they owned the property.

Source of information: AMC 1994, CDH files, EPA files.

G-6. Are there records or knowledge of accidents or spills involving site wastes? Are there Emergency Response Notification (ERNs) reports for this location?

None.

Source of information: EPA files.

G-7. Describe existing sampling data and briefly summarize data quality (e.g. sample objective, age/comparability, analytical methods, detection limits, QA/QC, validatability):

Sampling of surface water is conducted periodically for the NPDES permit. Methods and QA/QC are unknown. BOR sampling has been conducted yearly to trace mercury and other metals loading in the Dolores River and its tributaries.

Source of information: BOR 1994, WMD 1994.

G-8. Is there any other local, state or federal regulatory involvement? Describe. Include permits, and names of contact individuals within each government organization.

AGENCY	PROGRAM	CONTACT	PHONE	PERMIT
CDH	NPDES	Kathleen Kalamen	692-3603	CO-0029793

G-9. Attach site sketch or schematic. Include all pertinent features including wells, storage areas, underground storage tanks, source areas, buildings, access roads, areas of ponded water. Refer to figure(s) submitted with text of report if appropriate.

Refer to figures 1 and 2.

SOURCE CHARACTERIZATION

WC-1. Describe each source at the site, on Table 1, in terms of source type, containment, size/area/volume/quantity, and substances present. See HRS Tables 2-5 and 5-2 for source descriptions, Tables 3-2, 4-2, 4-8, 5-6, 6-3, and 6-9 for containment.

WC-2. Briefly describe how waste quantity was estimated (eg. historical records or manifests, permit applications, air photo measurements, etc.):

EPA's sampling team in 1984 estimated the total size and amount of source material on the site.

Source of information: EPA 1984a; EPA 1984b.

WC-3. Describe any restrictions or barriers to accessibility of on-site sources.

None.

Source of information: 1984b.

GROUNDWATER CHARACTERISTICS

GW-1. Any positive or circumstantial evidence of a release to groundwater? Describe.

Yes. Surface water and sediment sampling show metals loading to these media. Valley fill and alluvial material form an unconfined aquifer that potentially interacts with mine water discharge and surface water bodies. No specific groundwater sampling has been conducted other than mine discharge for NPDES monitoring.

Source of information: EPA 1984b; USGS 1900; USGS 1905; USGS 1974; WMD 1994.

GW-2. Any positive or circumstantial evidence of a release to drinking water users? Describe analytes, detection limits, background, hits, number of users, locations, QA/QC.

None reported. Three household use wells are within the four-mile target distance limit and serve approximately six residents. Two of these wells are approximately three-quarters of a mile upgradient. The other is located within the town of Rico, potentially near tailings used as road cover. All other drinking water sources are surface water diversions from above the site area.

Source of information: CDH files; EPA files; WMD 1994.

GW-3. Briefly describe the geologic setting.

Alluvial material from wash and landslides masks the underlying geology. A shallow unconfined aquifer exists in the alluvial material. The Cutler Formation is the youngest formation exposed at the site and is at least 2,800 feet thick. Fractures in bedrock forms a deeper aquifer. Geothermal Springs are found in the site area.

GW-4. Describe geologic/hydrogeologic units on Table 2. Give names, descriptions, and characteristics of consolidated and unconsolidated zones beneath the site.

GW-5. Is the site in an area of karst terrain or a karst aquifer?

No.

GW-6. Net Precipitation (per HRS section 3.1.2.2).

4.1 inches.

SURFACE WATER CHARACTERISTICS

SW-1. Mean annual precipitation (per HRS section 4.0.2)= 12.8". If less than 20", then count intermittent channels as surface water.

SW-2. Discuss the probable surface water flow pattern from the site to surface waters:

The tailings piles from the Rico-Argentine Mill are in Silver Creek with tailing ponds apparently draining directly into Silver Creek. The St. Louis Tunnel Adit drains into a slaked lime treatment system and then a series of settling ponds before discharging into the Dolores River. This discharge has a NPDES permit.

Source of information: EPA 1984b; WMD 1994.

SW-3. If surface water exists within 2 miles of the site, describe surface water segments within the 15-mile distance limit.

Segment Name	River/Lake/Type	Fresh/Salt Water	Start (mi.)	End (mi.)	Flow In cfs
Dolores River	River	Fresh	0	15	136
Silver Creek	Creek	Fresh	0	0.75	ND

Groundwater to surface water distance N/A Angle Θ _____

SW-4. Provide a schematic diagram or simple figure which describes surface water segments, locates targets, identifies flow direction, PPE(s), etc. Refer to figure(s) submitted with text of report if appropriate.

Refer to figures 1 and 2.

SW-5. Any positive or circumstantial evidence of a release to surface water? Evidence of a release by direct observation? Is the source located in surface water? Describe.

Yes. Tailing piles are placed in Silver Creek and tailings ponds are discharging to Silver Creek. Surface water and sediment samplings performed by BOR in Silver Creek and the Dolores River show metals loading occurring. The NPDES monitoring sampling show repeated exceedances of permit standards for metals.

Source of information: BOR 1994, WMD 1994.

SW-6. Any positive or circumstantial evidence of a release to surface water target populations? Describe analytes, detection limits, background, hits, number of users, locations, QA/QC.

No. An ACC contractor in the 1980s found decreased aquatic life in the Dolores River below the site but could not attribute the situation to the site. No target-specific sampling has been conducted at this site.

Source of information: EPA 1984b.

SW-8. Is the site or portions thereof located in surface water? Yes.

Is the site located in the 1 - ‹10 yr floodplain?

›10-100 yr?

›100-500 yr?

›500 yr?

SW-9. Two-year 24-hour rainfall 1.5"

TARGETS

T-1. Discuss groundwater usage within four miles of the site:

There are no municipal wells within the specified four-mile target distance limit. Five wells are listed by the CSE; one owned by the CDOT for wash water in a maintenance shop, one is listed as industrial use and three are listed as household use. Two of the household wells are approximately three-quarters of a mile upgradient and one is approximately three-quarters of a mile downgradient.

Source of information: CSE 1994, USDOC 1990.

T-2. Summarize the drinking water population served via groundwater within four miles of the site:

0 - 1/4 mi	1
1/4 - 1/2 mi	5
1/2 - 1 mi	0
1 - 2 mi	0
2 - 3 mi	0
3 - 4 mi	0

Attach calculations for population apportionment in blended systems.

T-3. Identify and locate any of the following surface water targets within 15 miles of the site: drinking water population(s) served by intakes, fisheries, sensitive environments described in Table 4-23 of the HRS, and wetlands as defined in the Federal Register.

Targets	Dist. From Site	SW Body	Flow In cfs	Population Served/Size (Incl. Units)	Contamination Known/Suspected
Montane riparian	4 miles	Dolores River	136	ND	Metals
Dolores Fishery	1 mile	Dolores River	136	ND	Metals

One surface water diversion is listed as multiple use including domestic. This diversion is the St. Louis Tunnel, actual domestic use is unknown.

T-4. Summarize the population within a four-mile radius of the site:

	Total Pop.	Worker Pop.
on site	0	0
0 - 1/4 mi	0	
1/4 - 1/2 mi	8	
1/2 - 1 mi	76	
1 - 2 mi	18	
2 - 3 mi	10	
3 - 4 mi	11	

T-5. Identify and locate any terrestrial sensitive environments described in Table 5-5 of the HRS.

Potential habitat for federal candidates species, North American Wolverine and Northern Gas Hawk. Potential habitat for federally listed threatened and endangered Bald Eagle, Peregrine Falcon and Mexican Spotted Owl. Potential habitat for montane riparian forest that is ranked very rare globally and in Colorado.

T-6. Describe any positive or circumstantial evidence of a release to air target populations? Of a release by direct observation where target population exists within 1/4 mile of the site? Describe analytes, detection limits, background, hits, number of users, locations, QA/QC.

No air monitoring has been conducted at this site. No observations are available concerning dust from tailings or ponds blowing off-site.

T-7. Identify and locate any potential or known resident soil exposure populations, if present. Describe conditions which lead the researcher to suspect contaminated soil within 200' of residences, if this condition exists.

None known.

TABLE 1
WASTE CONTAINMENT AND HAZARDOUS SUBSTANCE IDENTIFICATION[1]

SOURCE TYPE	SIZE (Volume/Area)	ESTIMATED WASTE QUANTITY	SPECIFIC COMPOUNDS	CONTAINMENT[2]	SOURCES OF INFORMATION
Tailing piles, ponds	75 acres	400,000 tons	Heavy metals, cyanide	None	CDH files; EPA files
Mine adits		1.5 million gallons per day	Heavy metals	Lime treatment system	WMD files

[1] Use additional sheets if necessary.

[2] Evaluate containment of each source from the perspective of each migration pathway (e.g., groundwater pathway - non-existent, natural or synthetic liner, corroding underground storage tank; surface water - inadequate freeboard, corroding bulk tanks; air - unstabilized slag piles, leaking drums, etc.)

TABLE 2
HYDROGEOLOGIC INFORMATION[1]

STRATA NAME/DESCRIPTION	THICKNESS (ft.)	HYDRAULIC CONDUCTIVITY (cm/sec)	TYPE OF DISCONTINUITY[2]	SOURCE OF INFORMATION
Alluvial Fill	10-40	10^{-2}	None	EPA 1984b; Office of the Federal Register 1990; USGS 1900; USGS 1905; USGS 1974
Bedrock (Cutler and older Formations)	› 2,800	10^{-5}	None	EPA 1984b; Office of the Federal Register 1990; USGS 1900; USGS 1905; USGS 1974

[1] Use additional sheets if necessary.

[2] Identify the type of aquifer discontinuity within four-miles from the site (e.g., river, strata "pinches out", etc.).